Example 7: Mathematics and Statistics, Number and Measurement, Level 3 - Growth industry

FROM THE ONLINE RESOURCE *INCLUSIVE PRACTICE AND THE SCHOOL CURRICULUM*

This example demonstrates how a teacher differentiated and adapted a Figure It Out task to support the learning of all her students in Number and Measurement. The teacher was focusing on number strategies for solving problems involving area and perimeter. Students needed to apply their number knowledge and strategies to calculate the area and perimeter of a greenhouse and how much it would cost.

Task

Growth Industry (*Measurement*, Figure It Out, Level 3, p. 5)

The task is appropriate for students working at level 3 of the curriculum for Mathematics and Statistics, but with well-planned differentiations and adaptations – reducing the mathematical demands of the task and the use of authentic contexts – students working at levels 1 and 2 could achieve success.

New Zealand Curriculum achievement objectives

Level 1

- Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions.
- Order and compare objects or events by length, area, volume and capacity, weight (mass), turn (angle), temperature, and time by direct comparison and/or counting whole number of units.

Level 2

- Use simple additive strategies with whole numbers and fractions.
- Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time.
- Partition and/or combine like measures and communicate them, using numbers and units.

Level 3

- Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
- Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), turn (angle), temperature, and time.
- Find areas of rectangles and volumes of cuboids by applying multiplication.

Opportunities to use and develop key competencies

Students were *thinking* as they asked questions to clarify their understanding and as they justified their answers. They were *relating to others* when they worked with a group and shared their understanding. Students *used language, symbols, and texts* to communicate their group's ideas, drawing on a range of representations including materials and digital means. Students were working in small groups, *participating and contributing* to complete a collaborative task.

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Class description

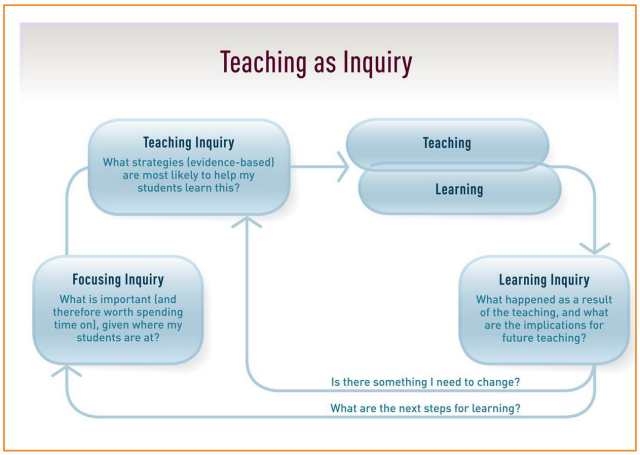
Ms Latu has a year 5–6 class that has 27 students, 10 boys and 17 girls. 45 percent of this class identify as Māori and 25 percent identify as Pasifika.

- **Moana** has low vision. Her visual acuity is 6/36, which means she needs to sit close to any material being presented in class. With adaptations to materials (e.g., enlarged print with no coloured background), she is able to participate and learn alongside her peers. Moana is working within the expectations of level 3 in mathematics. She receives additional support through the Ongoing Resourcing Scheme, which includes support for her teacher from Mr Richards, Resource Teacher of Vision (RTV).
- **Harry** has Down syndrome with learning delay. He communicates using body language and gesture, simple verbal language, and New Zealand Sign Language (NZSL). He is becoming more confident in expressing his ideas with people he knows and likes. He is progressing within level 1 of the curriculum and receives specialist services (from the local Ministry of Education office) and specialist teacher support through the Ongoing Resourcing Scheme (ORS). The priority learning goals in his Individual Education Plan (IEP) relate to building his knowledge of spatial vocabulary used in the classroom. Mathematics is an area of strength for Harry, which is why this learning theme has been identified for developing his use of NZSL. Each term, Ms Latu, Miss Meredith (the specialist teacher), and team members from the local Ministry of Education office meet to plan with Ms Latu for Harry's learning within the classroom. This term, the speech language therapist made suggestions about vocabulary Harry could learn within the mathematics unit on area and perimeter.

Read more about planning using an IEP.

- Four students (**Sara**, **Jenni**, **Yasmin**, and **Allana**) were identified by Ms Latu and the learning support coordinator as working at level 1 of the curriculum and using counting on to solve problems (stage 4 of the Number Framework). Through discussion with the students and their parents, it has been noted that the students do not see themselves as successful learners in mathematics. The students receive two layers of support: firstly they are grouped in mixed-ability small groups in the classroom, working with students at stages 5–6, and secondly they receive additional mathematics instruction (45 minutes, three times a week) with Ms Neilson, the mathematics support teacher (MST). Ms Neilson and Ms Latu work collaboratively with the four students once a week within the classroom mathematics lesson so that their learning transfers between settings.

Teaching as inquiry



Ms Latu used a range of evidence-based strategies to support all students to access the key mathematical ideas about area and perimeter. She focused her teaching inquiry on the impact that mixed-ability groupings had on student attitudes towards mathematics and on shifting student outcomes. For this task, she differentiated the content so that students could access the key mathematical ideas, and she connected the context to the school-wide inquiry on developing a sustainable garden. She wanted the students to see how mathematics plays an important role in our daily lives. She provided a range of representations for students to use to explore the concepts, and she enabled them to share their thinking using multiple ways of responding, including digital technology.

Ms Latu used the Figure It Out task as a starter activity to introduce students to the key mathematical ideas of area and perimeter. She wanted the students to explore varying areas and perimeters, encouraging them to connect their strategies and basic facts knowledge to help them solve the problems. In this initial lesson, students were able to select from the following areas to explore: 12 m^2, 16 m^2, and 24 m^2. Learning about area and perimeter connected with the school-wide inquiry, which, for the class, involved building four garden beds to grow their own food.

Focusing inquiry

What was important (and therefore worth spending time on), given where Ms Latu's students were at?

Ms Latu had identified that students in her class were using number strategies from stage 1 to stage 6 from the Number Framework (equivalent to levels 1 to 3 of the curriculum). She had arrived at this conclusion through the use of formative assessment strategies (observations, student work, conversations with students, a modelling book, and anecdotal notes) and assessment tools (GloSS and JAM). The class had also completed an e-asTTle assessment focused on measurement at the end of the previous term. In this, the majority of students had demonstrated confusion between perimeter and area and were using additive rather than early multiplicative strategies to solve area problems.

Teaching inquiry *What teaching strategies (evidence-based) helped Ms Latu's students learn?*	Learning inquiry *What happened as a result of the teaching, and what were the implications for future teaching?*
Differentiating the content and making connections to prior learning • Ms Latu carefully considered the areas that she wanted the students to explore and how to connect with their current knowledge to extend and challenge their understandings. She offered three areas for groups to select from initially (12 m^2, 16 m^2, and 24 m^2), before they could move onto the areas of 36 m^2 and 64 m^2 in the task. – She selected 12 m^2 and 16 m^2 because she wanted Sara, Jenni, Yasmin, and Allana to use their doubles and experience success early in the task. – She selected 24 m^2 because it would provide lots of opportunities for additive and early multiplicative thinking to surface in the mixed-ability group discussions. – Once Harry's group had done 24 m^2, Sarah (the teacher's aide) took him aside to review Harry's new NZSL signs and to practice these.	Ms Latu: *Offering the students a choice of areas to work on made them consider how all learners in their group could access the ideas about area and perimeter. Harry was able to use some spoken language and NZSL to demonstrate to his group his knowledge. Sara and Yasmin decided to start with 16 as Sara quickly said, "8 + 8 = 16, so we can make two rows." The other two girls supported Sara and Yasmin to see this as a multiplication fact.* Harry's group: *We didn't know Harry was so good at maths.* Sarah: *Tomorrow I will review Harry's new NZSL signs with him before mathematics so that he is more confident in using these with his group.*

The teacher provided support to ensure the students could build on their prior knowledge to access the task.

With your colleagues, discuss: What prior learning experiences and interests can you connect with to engage **all** students in mathematical tasks?

Teaching inquiry *What teaching strategies (evidence-based) helped Ms Latu's students learn?*	Learning inquiry *What happened as a result of the teaching, and what were the implications for future teaching?*
Providing engaging contexts • After talking with Mr Richards (RTV), Ms Latu started the lesson by getting all students to 'get a feel for a metre' by locating things in the class that were a metre long, identifying where a metre was on their body, and pacing out a metre. This supported all students to get a sense of size: of both a metre in length and a square metre. (This was especially important for Moana, as body referents are helpful for students with visual impairments.)	
• Ms Latu needed to initially engage two groups of students (including Sara, Jenni, Yasmin and Allana) in the task by questioning them about what they would grow in their garden box. It was important for all participants to connect with the task and context, so Ms Latu gave the students the opportunity to make these choices in this early part of the task. • Following this conversation, Ms Latu noticed that the two groups were more motivated to participate in the task and, when questioned again, were able to discuss what area and perimeter were.	Ms Latu (in conversation with Jenni's group): *So what could you plant in your garden?* Jenni: *Veges, I suppose.* Ms Latu: *What else?* Allana: *You mean it doesn't just have to be veges? We could plant flowers? Let's plan a rainbow garden with some flowers and some veges …* Ms Latu: *The girls described the perimeter as the part where the flowers would be – around the edge; then with prompting, they used their doubles to show how they worked it out. They were no longer counting, so I have evidence of a shift in thinking towards level 2.*
Identifying appropriate materials • Ms Latu carefully considered what materials would support all learners to access the key mathematical ideas of the task. For example, she provided: – the task enlarged to A3 and in black and white for all students – large pieces of card for all the groups to make 1 m squares that they could lay out on the concrete and draw around with chalk. Harry's group used this material to support them all to see the size of a garden – multi-link cubes and a black-line grid so that groups could transfer their outside models to representations back in class. The grid was designed with Moana in mind; it had 2 cm squares and 3-point line thickness in black. – NZSL prompt cards on a clip ring to support Harry to use his new NZSL signs.	Mr Richards (RTV): *At the start of the term, Ms Latu and I met to discuss the term's maths programme. This gave an opportunity for Ms Latu to reflect on the previous term and share about Moana's learning. We then looked at the key materials that would need to be adapted so Moana could access the mathematics in each task. As the year progresses, Ms Latu is transferring previous adaptations to the new learning.* Ms Latu: *I noticed that the majority of the students selected the larger squares to work with in preference to the smaller grid lines in their maths books. Adaptations are good for all learners, not just the one student I had in my mind.* Sarah (teacher's aide): *Harry's group were very interested in the NZSL cards and enjoyed practising the signs with Harry.*

The teacher used practical means and contexts that engaged students' interest.

With your colleagues, discuss: How can you select contexts to ensure that **all** students engage and connect with mathematical tasks?

The teacher provided adapted materials to support students' access to key mathematical ideas in the task.

Read more about adapting supports so that all students can access the task and experience success.

Teaching inquiry *What teaching strategies (evidence-based) helped Ms Latu's students learn?*	Learning inquiry *What happened as a result of the teaching, and what were the implications for future teaching?*
Using peer support • Observing her students in mixed-ability groupings had confirmed Ms Latu's belief that all students can learn from each other and that it is important to take the time to develop collaborative working relationships. For this task, Ms Latu allowed the students to work in self-chosen groups of 3–4 students. Together they had to select an area so that they could all access the ideas about area and perimeter. • The students then shared back to the class how their thinking had progressed in their group, and they answered questions about each other's thinking. • Ms Latu reminded the students that they could get a talk stem sheet (see examples below) to ask questions of the group or to support sharing their thinking. These talk stems were generic and students used them across the day in other curriculum areas. Two examples were: When asking peers about their thinking: – *I have a question about …* – *Can you tell me more about …* – *What did you mean by …* To share their understanding: – *I solved it by …* – *I know that… because …* – *I did it a different way, I went …* • Harry had some talk stem cards with matching signs so that his peers could sign a question or feedback statement. Talk stems that Harry used included: – *I counted …* – *… and … makes … (He writes the numbers in).*	Ms Latu: *It was great to see the support within the groups. Moana was able to participate with her peers as the materials were big enough for her to see. As Moana finds black and white easier to view, her peers sorted out only black multi-link cubes for their group to use.* Harry's mum: *I have noticed that Harry is using more sign language to communicate. I think the talk stems are helping him to communicate his ideas. I think I will get a copy to use at home.*

Students worked in groups on the task, then shared back to the class.

With your colleagues, discuss:
How can peer interactions provide opportunities for **all** your students to contribute to mathematical tasks?

What strategies from other settings can you use to support **all** students?

Teaching inquiry *What teaching strategies (evidence-based) helped Ms Latu's students learn?*	Learning inquiry *What happened as a result of the teaching, and what were the implications for future teaching?*
Assessing to recognise learning • Ms Latu formatively assessed the students' mathematics levels based on learning conversations and what she had noticed during the lesson. She made anecdotal notes in her assessment book, indicating which numeracy strategy stage students' thinking aligned with.	Ms Latu noted: *I noticed Yasmin and Allana were using their doubles to solve problems when working out the 12 m^2 options. Their peers had encouraged them to use facts that they knew and they had instantly gone to doubles. Allana was very clear in her explanation, "3 + 3 = 6, then that is another 3 + 3 = 6, so I double the 6 and that gives us 12 squares." Tomorrow I will get their group to look at 24 m^2 to see if they can transfer this strategy to solve another problem. I will also feed in the language to shift them towards the language of multiplication rather than addition.*
• Ms Latu also looked at engagement in the task and within the groups and wrote down descriptions of it. She selected several to share back with the class to illustrate what engagement sounds like in mathematics as the class term goal was how to be an engaged learner.	
• Sarah (teacher's aide) recorded a video of Harry's group working collaboratively outside and the strategies the individual students were using to create their area model. The video captured Harry using his new NZSL signs and this was shared with the class at the end of the lesson to demonstrate shifts in learning. Sarah supported Harry to put the video on his e-portfolio page to share with his family.	Sean (responding on video after working with Harry): *I knew Harry was good at counting as he likes to do this when we line up. Having the NZSL cards helped us to understand Harry's signing. Tomorrow we will count the perimeter together and see if he can get even further.*

The teacher documented learning shifts for some students and shared aspects of them with the class.

With your colleagues, discuss: How do you ensure meaningful assessment to celebrate learning for **all** your students?

Next steps

Now that you have explored this example, work with colleagues to:

- consider the challenges and opportunities in relation to inclusion for *your* students
- decide on the next steps in your mathematics teaching to ensure *all* your learners are participating, learning, and achieving
- plan for a future meeting to review the impact of your next steps and what *now* needs to happen.

Recommended resources

Accelerated Learning in Mathematics support materials on the NZ Maths website

Helping students to participate in learning conversations on the NZ Maths website

Mathematics learning stories on the BLENNZ Learning Library (Search 'mathematics')

Resources for New Zealand Sign Language on the Deaf Aotearoa website, including toolkits for schools